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ABSTRACT

This study was conducted to determine whether the filmic coding elements of split screen, slow motion, generated line cues, the zoom of a camera, and rotation could aid in the development of the Euclidean space concepts of horizontality and verticality, and to explore presence and development of spatial skills involving these two concepts in adolescents. Participants included 240 randomly selected freshman and senior high school students (15 males, 15 females). Pretests and treatment were conducted on two consecutive days. On the first day, all subjects were tested for knowledge of the concepts of horizontality and verticality; the Group Embedded Figures Test (GEFT) and Part V of the Guilform-Zimmerman Aptitude Survey (GZAS) were also administered. Each treatment group viewed one of three television tapes used to present examples of the invariant horizontality of liquid and the verticality of objects; each tape used one of the three processes of activation, short-circuiting, and supplantation. The control group viewed a neutral tape. Following treatment, subjects were again tested on horizontality, verticality, and Part V of the GZAS. Findings reveal clear patterns of performance by sex and grade level. They also support the hypothesis that filmic coding elements do affect the development of concepts of horizontality and verticality and increase mean scores on the GZAS. A list of references is provided. (JB)

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Effects of Selected Filmic Coding Elements of TV on the Development of the Euclidean Concepts of Horizontality and Verticality in Adolescents

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Investigation of the function and effects of selected filmic coding elements of television in learning and employment of those filmic coding elements in exploring the presence and development in adolescent high school students of spatial skill involving concepts of horizontality and verticality were the two major objectives of this study. The structure of the study combined approaches established by G. Salomon in the area of filmic coding elements and L. Liben in her work with Piagetian spatial concepts.

The inquiry was concerned with the differential role of media's symbol systems in the acquisition of knowledge and in the way these symbol systems can function as cultivators of mental skills. The particular area of knowledge pertained to the Euclidean space concepts of horizontality and verticality which involve the mental ability of spatial orientation.

Rationale

Based on the general premise that the symbol system is the most essential attribute relating the two "systems" of media and cognitions, Salomon argues,

> "symbol systems address themselves to different aspects of the world, and that some systems render specific aspects better than others ... Symbol systems vary as to the cognitive systems they address, and given a particular content, person, and task, the information they carry requires different amounts of mental recoding and elaboration. Thus the better the correspondence between the way information is presented, the less recoding is needed and the easier is the communication" (Salomon, 1979,p. 86).

To learn how media's symbol systems can be made to affect cognition under specific favorable conditions coding elements of media's symbol systems were used to activate, short-circuit or supplant processes for various types of learners. Activation stimulates or calls into action skills with which a learner has an initial acquaintance. In short-circuiting the coding elements provide ready-made results for the skill, while in supplantation the entire skill process is modeled. Coding elements that activate skills facilitate skill mastery in already skillful learners; coding elements that overtly model (supplant) skills facilitate skill-mastery in initially unskilled learners.

In dealing with learning tasks and cultivating mental skill mastery in the area of spatial relations film and television contain in their symbol systems specific codes to represent relatively unique transformations in space and time (e.g., slow motion, the zoom of a camera, rotations, split screen, and generated line cues). These coding elements were used to present the Euclidean space concepts of horizontality and verticality to high school adolescents.

Although Piaget and Inhelder (1956) maintained that a Euclidean spatial system is typically established by late childhood, other research found that children from nursery school through the eleventh grade (only girls were included from ninth to eleventh grade) and many college students were unsuccessful on horizontal water-level tasks (Thomas, Jamison and Hummel, 1973; Willemsen and Reynolds, 1973; Thomas and Jamison, 1975; and Harris, Hanley and Best, 1975). Verticality tasks (drawing trees and houses on hills with various degrees of incline) were introduced in Liben's study (1978). Working with seniors in high school, Liben found a sex-related

difference to be present with both tasks of verticality and horizontality. Evidence indicated that imperfect performances by males and females showed no significant difference in number or type of task errors, nor in scores on field dependence/independence (EFT) and spatial orientation (Guilford-Zimmerman) measures. Performance on the Piagetian spatial tasks were significantly correlated with performance on the EFT in both sexes. In general males performed significantly better than females.

This study attempted to ascertain whether the filmic coding elements of split screen, slow motion, generated line cues, the zoom of a camera and rotation could aid in the development of the Euclidean spatial concepts of horizontality and verticality and the skill mastery of spatial orientation in adolescents.

Questions specifically addressed were

1. Would the type of filmic coding elements used in presenting Euclidean spatial concepts significantly affect the mean score of high school adolescents on a test based on those concepts;

2. For learners who have similar levels of understanding would the type of filmic coding element used in presenting Euclidean spatial concepts significantly affect the mean score on a test of those concepts given prior to and following the presentation;

3. Would there be a significant difference in the mean score of high school adolescent males and females on a test of Euclidean spatial concepts following the viewing of a television tape using selected filmic coding elements;

4. Following the viewing of a television tape using selected filmic coding elements would there be a significant difference in the mean score of high school adolescent ninth-graders and high school adolescent twelth-graders on a test of Euclidean spatial concepts;

5. Would the viewing of television tapes using selected filmic coding elements to provide training on Euclidean spatial concepts significantly affect the mean score of high school adolescents on the Gilford-Zimmerman Aptitude Survey, Part V Spatial Orientation?

Procedure

Two-hundred-forty randomly selected subjects for the study were placed in four groups composed of fifteen male and fifteen female freshman and senior adolescents. They were all from one four-year north-central Kansas public high school of about 1025 students.

They were all pre-tested for mastery level of the concepts of horizontality and verticality. The horizontal test involved drawing in the water level of half filled cup outlines positioned at various degrees of tilt. The vertical concept required the subject to draw trees on hills with various degrees of slope and to draw bulbs hanging from wires in trailers parked on hills with various degrees of incline. The Group Embedded Figures Test (GEFT) and the Guilford-Zimmerman Aptitude Survey-Part V Spatial Orientation were administered to all subjects before treatment.

A repeated measures, 4x2x2x2 factoral design, employing two MANOVAs was used. The factors were the two sexes, the two high school grade levels of freshman and senior, high and low groups of EFT scores, four experimental groups and pre/post tests. There were three treatment groups and a control group. The treatment conditions were those of activation, short-circuiting and supplantation used by Salomon (1974b). The repeated measures were the tests of horizontality, verticality and Part V Spatial Orientation of the Guilford-Zimmerman Aptitude Survey. The horizontal and vertical measures were used to reflect knowledge of those concepts and determine if any gain in those concepts occurred following treatment. The Spatial Orientation section of the GZAS was used to indicate if any mental skill development in the area of spatial relations occurred following treatment.

Tests and treatment were conducted on two consecutive days. On the first day all subjects were tested for knowledge of the concepts of horizontality and verticality. The GEFT and Part V of the GZAS were also administered. On the second day each group viewed one of four television presentations. Three television tapes were used to present examples of the invarient horizontality of liquid and the verticality of objects (people, trees and houses). One of each of the three processes of activation, short-circuiting and supplantation was employed in one of the tapes. The control group viewed a television tape of nature scenes set to music. Task booklets were used during the treatment portion. They were made up of outlines which corresponded to objects which appeared in the treatment tapes. At various places throughout the tapes the subjects were asked to perform a task which pertained to the concepts being demonstrated.

Using the SPSS^{X} language and operations, two MANOVAs were computed for the dependent variables of horizontality, verticality and spatial orientation. Means and standard deviations were computed for both pre and post test measures of horizontality, verticality andPart V of the GZAS for subjects in the supplantation, short-circuiting, activation and control groups. Phillais, Hotellings and Wilks multivaritate tests of significance were employed to determine if significant differences existed among the mean scores of the various groups. Univariate F-tests were carried out. All factors from four-way interactions to each individual factor of sex, grade level, treatment condition, and time of the first MANOVA and sex, EF scores, treatment condition, and pre and post test scores of the second MANOVA were examined. Graphs were drawn for all findings which revealed significant differences at the .05 or lower level of probability.

Results

Findings for the study came from the examination of two MANOVAs. The first one was based on data for the variables of sex, grade level, treatment group, and time. The second MANOVA included the independent variables of sex, EF scores, treatment groups and time. These two MANOVAs were computed for each of the dependent variables of horizontality, verticality and spatial orientation.

In determining whether the type of filmic coding elements used in presenting Euclidean spatial concepts would affect the performance of high school adolescents on tests based on those concepts the results of the MANOVA based on the interaction between Treatment Group x Time on the horizontal measures produced non-significant multivariate f-tests ($p<.198$). However the univariate F-test for the pre and post test measures on the curved cup outline was of borderline significance ($p<.057$). A look at

the graph of the pre and post test results of the four experimental groups revealed that the supplantation and short-circuit groups appear to relfect the largest amount of change.

As for the vertical measures the multivariate F for Treatment X Time was significant ($p<.043$). The univariate F-tests revealed a level of significance for the test with trees on hillsides was .253 but for the hanging bulb test the level of significance was .031. On viewing the graphs of the pre and posttest scores for the hanging bulb test it can be seen that the activation group achieved a change greater than twice that of the control group and that the short-circuit group increased their scores over four times that of the control group.

In addressing the question of the affect of filmic coding elements used in the presentation of Euclidean spatial concepts to learners of similar levels of understanding the multivariate F for the interaction of Treatment Group X EF scores X Time was non-significant ($p<.687$) on the horizontal measures. Once again on the vertical measure the MANOVA using Sex X Group X EF scores X Time provided a four-way interaction having a multivariate F at the .017 level (Pillais, Hotellings and Wilks).

The univariate F-test was non-significant ($p<.100$) for the difference on the drawing of trees on inclines but the univariate F for the difference on the drawing of bulbs hanging in trailers parked on inclines was significant ($p<.026$). A look at the graphs of these findings for the bulb in trailer test reveal a consistent pattern of higher results for EF2 (high scores) group over those of the EF1 group. The level of performance by both EF1 and EF2 is not as high for females as for males.

Treatment Group X Time interaction for the multivariate test produced an F which was significant ($p<.039$). The univariate F-test for the bulb in trailer measure was significant at the .025 level. The various treatment groups do not follow the same pattern for either the male or female or the two levels of EF. The short-circuit group shows the greatest gain from pre to posttest scores for both male groups. For the females, activation appears to be the most effective for the EF 1 group, but supplantation and short-circuit seem to be the most productive for the EF 2 group. This would not follow the work or findings of Salomon.

In checking on the role of sex in the performance of adolescent males and females on measures of verticality the test scores show a significant multivariate F-test ($p<.001$). This substantiated the superior adolescent male performance over adolescent females found in past studies (Liben, 1978).

As for the role of grade level on the effect of filmic coding elements in working with concepts of verticality the multivariate test (Pillais) which deal with the average mean score for the two levels produced a non-significant f ($p<.157$). The univariate F-test for the average mean score on the test of verticality for the bulb in trailer test was .075. The results of the MANOVA for the interaction of Time X Level revealed a significant univariate F ($p<.040$) for the mean scores on the bulb in trailer test. The graph of Level X Time pictures the greater increase made by seniors over that of the freshman on the vertical measure of the bulb in trailer.

The evidence of these two significant differences in sex and grade level for both the horizontal and vertical measures is most important to recall when interpertation of the other factors of the study are being reviewed.

A four-way interaction revealed by the first MANOVA on the horizontal measures produced a multivariate test of significance (Pillais) with a significant F ($p<.022$) for Sex X Group X Level X Time. The univariate F was non-significant for both the straight-sided cup outline ($p<.067$) and for the curve-sided cup outline ($p<.100$).

Examination of the graphs of the four-way interaction show the senior males had higher retest mean scores in all groups, scoring above freshman males and both freshman and senior females. Senior females scored consistently above the freshman female mean scores on the retest measures and surpassed the freshman male performance in the short-circuit and activation groups.

Senior girls narrowed the difference in the mean scores for males and females at the senior level in both the supplantation and activation groups. Freshman girls made gains on the repeated measures mean scores over freshman boys in the short-circuit and activation groups, but the freshmen boys showed larger gains over the freshman girls in the supplantation group. The freshman girls performed well below the senior boys in all groups.

As for the effect of the various treatments, the short-circuit and activation appeared most effective for senior boys. The freshman boys showed their greatest gain in the supplantation group. All three treatments proved beneficial for senior girls with activation and supplantation supplying the greatest rate of gain. Freshman females appeared to benefit most from the short-circuit tape.

The existence of this four-way interaction points out the difficultly of trying to understand the influence of the filmic coding elements in the light of the complexity of the sex and level related differences which have been noted.

Whether the use of filmic coding elements in providing training on horizontal and vertical tasks could have any effect on the skill mastery of spatial orientation was the final concern. Part V, Spatial Orientation, of the Guilford-Zimmerman Aptitude Survey was used to measure the mental ability of spatial orientation. Using sequential sums of squares, the first MANOVA revealed a four-way interaction of Sex X Group X Level X Time which produced a significant F at the .015 level.

These interactions were graphed holding various groups constant. In looking at the graphs of the senior and freshman levels of the males in the various treatment groups there is a similar pattern for the pre/posttest performance of senior males for the control, supplantation and activation groups. The short-circuit tape appears to have suppressed the change which occurred in the other three groups. The sequential sum of squares for the freshman males revealed the short-circuit treatment provided the greatest increase from the pre to posttest GZAS test scores. The pre/post gain for the activation group was also at a steeper rate than that of the control group. The males performed at higher levels and showed greater gains in the activation group than in the other experimental groups.

For the females, the graphs of the various experimental groups' sequential sum of squares showed the short-circuit and supplantaion groups increased at the most rapid rate for the senior subjects. The activation group for senior females showed little change from pre to post means. Freshman females registered their greatest pre/post GZSA score gain in

the supplantation and activation groups. The short-circuit group provided little if any change in pre/post GZAS test scores for freshman female.

The F for the mean square of the interaction of Level X Time was significant at the .055 level. The senior' mean square was at a higher level than the freshman on both the pre and posttest administration of the GZAS.

Looking at the GZAS averages determined by use of sequential sums of squares it shows that sex has a significant F at the .004 level. A look at the graph shows the males scoring significantly higher then females. The graph showing the senior and freshman performances on the GZAS reveals significantly better scores by the seniors than the freshmen. Rather clear patterns of performance for sex and grade levels were established.

Implications

From the significant findings for individual factors and the various interactions it does appear that filmic coding elements do affect the development of the Euclidean concept of horizontality and verticality and did increase the mean scores on the Gilford-Zimmerman Aptitude Survey, Part V Spatial Orientation of high school freshman and senior adolescents.

Further investigation into the effects of selected filmic coding elements needs to be pursued keeping sex, grade level, concept understanding, treatment groups and time all as factors.

The shape of the container of the horizontal tasks does appear to have some effect on the mental processes of the subject, but results of the horizontal tasks did tend to form similar patterns and produce common significant findings.

For the vertical measures there were consistently different results indicating different aspects were being involved. The question of filmic coding elements widh might aid in development of understanding of each of those aspects of the concept of verticality would be open for investigation.

The presence and degree of development of the concepts of horizontality and verticality of freshman and senior adolescent subjects remains an area meeding further exploration. The work of Feldman (1980) might provide useful guidelines in studying the presence and development of the concepts.

Reduction of the difference in the mean score for various treatment groups between males and females needs to be followed up to fill in a vital part of the total picture.

The flat pre/post mean scores produced by the low EF groups indicate the need to look into this aspect of the study. Male and female adolescents who have scored in the lower EF group should be studied to see if any particular selected coding elements are more beneficial than others in helping them to master the horizontal and vertical concepts.

The significant findings based on the use of the Guilford-Zimmerman Aptitude Survey to reveal development of the mental skills of spatial orientation in adolescents through the use of selected filmic coding elements would be of import to those involved in education and those who have an interest in occupations which employ spatial orientation skills.

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